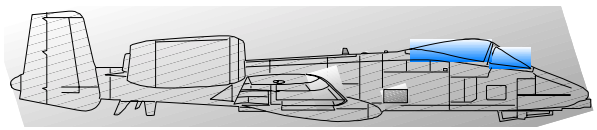
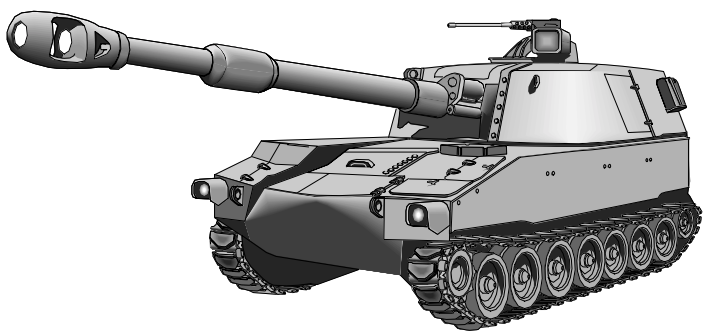
CAS ROE
NTC LIVE FIRE

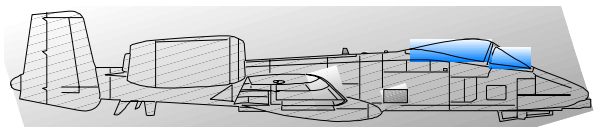


ALTITUDE DECONFLICTION OF ARTILLERY FIRES AND CLOSE AIR SUPPORT



SIMULTANEOUS CAS - ARTILLERY TARGET ATTACK

WHY USE ALTITUDE SEPARATION?



FOR SEAD PURPOSES, IT IS SOMETIMES DESIRABLE FOR THE ARTILLERY TO PROVIDE CONTINUOUS SUPPRESSION ON THE CAS TARGET OR ADA SYSTEM. BY ESTABLISHING ALTITUDE AND LATERAL SEPARATION CONTROL MEASURES, YOU CAN ENSURE SAFE FIGHTER CLEARANCE FROM THE ARTILLERY TRAJECTORY AND FRAGMENTATION PATTERNS.

SIMULTANEOUS CAS - ARTILLERY TARGET ATTACK

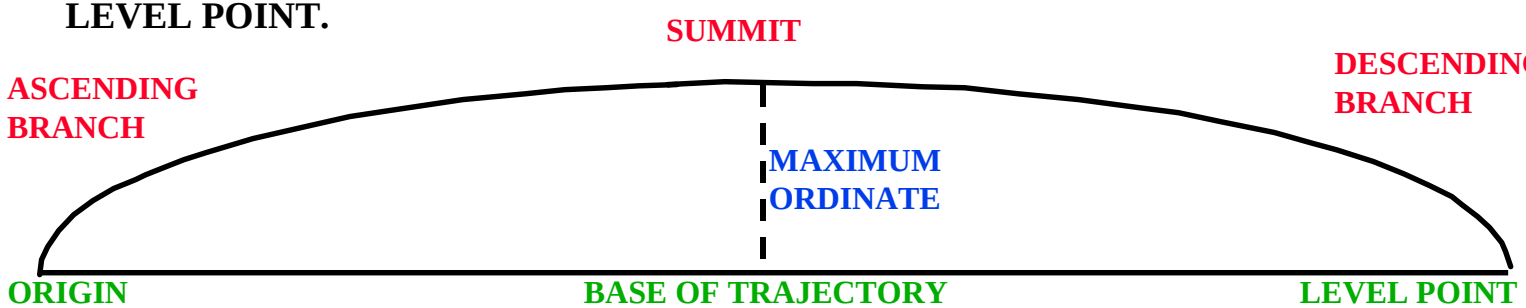
- **NTC ALLOWS UNITS TO UTILIZE ALTITUDE SEPARATION DURING TWO DISTINCT TARGET ATTACK SITUATIONS IN LIVE FIRE ATTACKS.**

  * **WHEN CAS AND ARTILLERY ATTACK THE SAME TARGET, i.e. THE SAME TARGET GRID IS PASSED IN CAS 9-LINE BRIEF AND THE ARTILLERY CALL FOR FIRE.**

  * **WHEN CAS AND ARTILLERY ATTACK SEPARATE TARGETS AND THE FIGHTERS MUST CROSS THE ARTILLERY GUN TARGET LINE.**

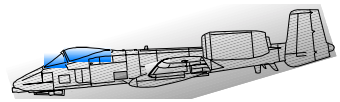
TRAJECTORY DEFINITIONS

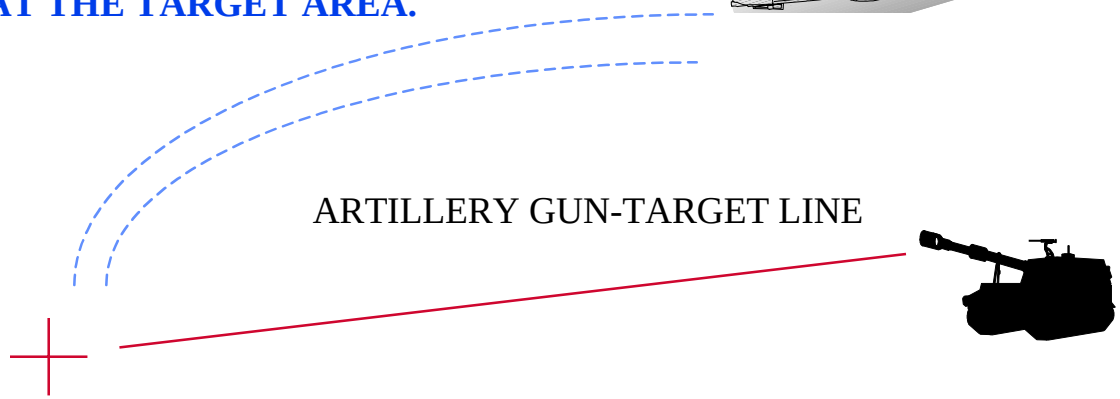
- **ORIGIN:** THE LOCATION OF THE CENTER OF GRAVITY OF THE PROJECTILE WHEN IT LEAVES THE TUBE.
- **ASCENDING BRANCH:** THE PART OF THE TRAJECTORY THAT IS TRACED AS THE PROJECTILE RISES FROM THE ORIGIN.
- **DESCENDING BRANCH:** THE PART OF THE TRAJECTORY THAT IS TRACED AS THE PROJECTILE IS FALLING.
- **SUMMIT:** THE HIGHEST POINT OF THE TRAJECTORY.
- **MAXIMUM ORDINATE:** THE DIFFERENCE IN ALTITUDE BETWEEN THE ORIGIN AND THE SUMMIT.
- **LEVEL POINT:** THE POINT ON THE DESCENDING BRANCH THAT IS AT THE SAME ALTITUDE AS THE ORIGIN.
- **BASE OF THE TRAJECTORY:** THE STRAIGHT LINE FROM THE ORIGIN TO THE LEVEL POINT.



CAS / ARTILLERY ATTACK - SAME TARGET

THE FIGHTERS APPROACH THE TARGET LATERALLY SEPARATED FROM THE ARTY GUN-TARGET LINE AND ONLY CROSS THIS LINE AT THE TARGET AREA.





THE TARGET AREA IS DEFINED AS THE ARTILLERY TARGET GRID WITH A 1,000 METER RADIUS AROUND IT.

THE MINIMUM SAFE ALTITUDE THAT AIRCRAFT CAN CROSS THE ARTILLERY TARGET AREA IS DETERMINED BY THE FORMULA "ORD 1" IN THE ROE OR 3,000 FEET AGL, WHICHEVER IS HIGHER.

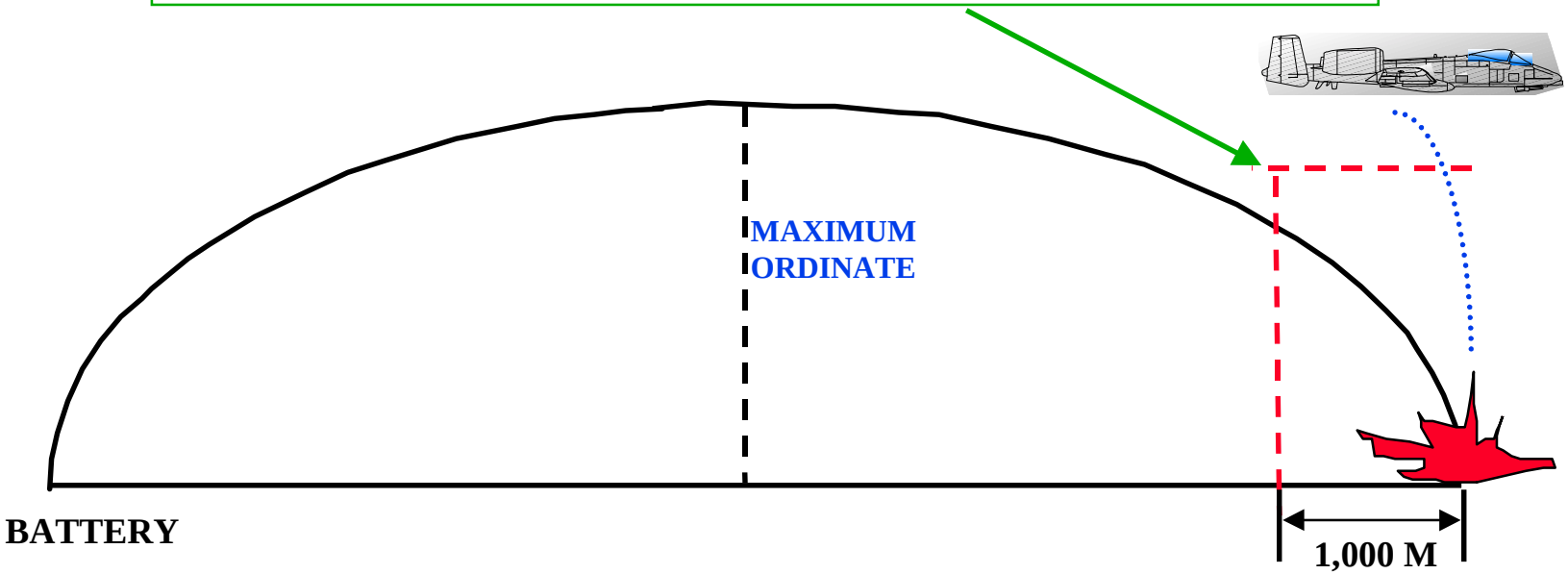
CAS / ARTILLERY ATTACK - SAME TARGET

- **" ORD 1 " REFERS TO THE ALTITUDE OF ANY GIVEN ARTILLERY TRAJECTORY AT A POINT 1,000 METERS SHORT OF THE TARGET, WITH A 1000 FOOT BUFFER ADDED. (THE METHOD TO CALCULATE ORD 1 IS CONTAINED WITHIN THE SLIDE PACKET.)**

- **"ORD 1" IS CALCULATED TO PROVIDE A SAFE ALTITUDE FOR CAS TO CROSS AN ARTILLERY TARGET AREA WHILE CONDUCTING A SAME TARGET CAS - ARTY BOMBING ATTACK.**

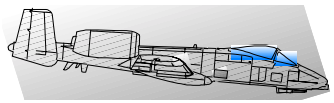
CAS / ARTILLERY ATTACK - SAME TARGET

ORD 1 = ALTITUDE OF THE TRAJECTORY + VERTICAL INTERVAL + 1,000 FEET (AT A POINT 1,000 METERS SHORT OF THE ARTY TGT).



ORD 1 IS USED TO ESTABLISH A SAFE STAY ABOVE ALTITUDE FOR FIGHTERS OVER THE TARGET AREA (USE THE CALCULATED ORD 1 ALTITUDE IF IT IS HIGHER THAN 3,000 FEET AGL).

CAS / ARTILLERY ATTACK - SEPARATE TARGETS

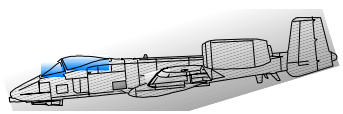


ATTACK HEADINGS WHICH CAUSE THE FIGHTERS TO CROSS THE GTL .

ARTY TGT
AB 7000

NOTE: THIS ASSUMES THAT THE FIGHTER INGRESS / EGRESS ROUTES COULD NOT BE LATERALLY OR TIME SEPARATED.

CAS TARGET



THE FIGHTERS ARE INSTRUCTED TO STAY ABOVE THE ARTY MAXIMUM ORDINATE + 1000 FEET FOR THIS TYPE OF ATTACK.

MAX ORD + 1000 FT IS USED WHEN FIGHTERS MUST CROSS THE ARTILLERY GTL SHORT OF THE ARTY TGT.

SIMULTANEOUS CAS - ARTILLERY TARGET ATTACK

ALTITUDE SEPARATION ROE

GENERAL REQUIREMENTS:

- **UNITS CANNOT USE A SINGLE MAXIMUM ORDINATE OVER THEIR SECTOR FOR AN ENTIRE BATTLE.**
- **ARTILLERY HIGH ANGLE, RAP, AND MORTAR FIRES WILL NOT BE SEPARATED BY ALTITUDE (USE TIME OR LATERAL SEPARATION METHODS ONLY).**
- **AIRCRAFT WILL NOT UNDERFLY INDIRECT FIRE GTLs.**

SIMULTANEOUS CAS - ARTILLERY TARGET ATTACK

ALTITUDE SEPARATION ROE

ARTILLERY REQUIREMENTS:

- **THE MISSION IS COORDINATED BY A TIME HACK OR TOT.**
- **THE FIRST FFE "VOLLEY" MUST IMPACT NLT 30 SECONDS PRIOR TO FIRST AIRCRAFT ON TARGET.**
- **NO FIRING UNITS MAY "JOIN IN" LATER.**
- **DO NOT CHANGE TRAJECTORIES.**

SIMULTANEOUS CAS - ARTILLERY TARGET ATTACK

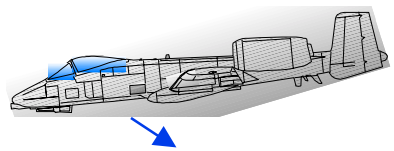
ALTITUDE SEPARATION ROE

REQUIREMENTS FOR FIGHTERS:

- **FIGHTERS MUST ADHERE TO THE FINAL ATTACK HEADING OR ATTACK ZONE PASSED TO THEM BY THE FINAL CONTROLLER**
- **FIGHTERS MUST REMAIN ABOVE THE STAY ABOVE ALTITUDE PASSED FROM THE FINAL CONTROLLER FOR THE ATTACK.**
- **TO ENSURE THE FIGHTERS REMAIN ABOVE ARTILLERY FRAGMENTATION AT THE TARGET AREA DURING A SAME TARGET ATTACK, THE MINIMUM ALTITUDE IS 3,000 FT AGL. NOTE: IF ORD 1 IS DETERMINED TO BE HIGHER THAN 3,000 FEET AGL THEN THE ORD 1 ALTITUDE IS USED AS THE CAS MINIMUM BOMBING ALTITUDE.**

DEFINING THE ATTACK ZONE

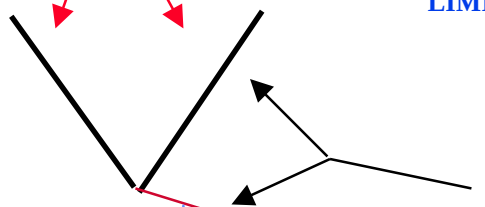
THE ATTACK ZONE LEFT AND RIGHT LIMITS ARE DEFINED TO THE FIGHTERS AS TWO ATTACK HEADINGS WHICH FORM A FAN OR CONE WITH THE APEX AT THE ARTILLERY TARGET.



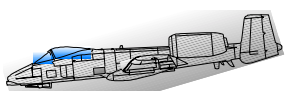
IP A

THE PILOT RECEIVES TWO ATTACK HEADINGS FROM THE ALO/ETAC. HE IS FREE TO INGRESS ANY WHERE WITHIN THE LEFT AND RIGHT LIMIT DEFINED BY THE ATTACK HEADINGS.

FIGHTERS ARE GIVEN EGRESS INSTRUCTIONS WHICH WILL PREVENT THEM FROM CROSSING ANY GTL AS THEY DEPART THE TARGET.

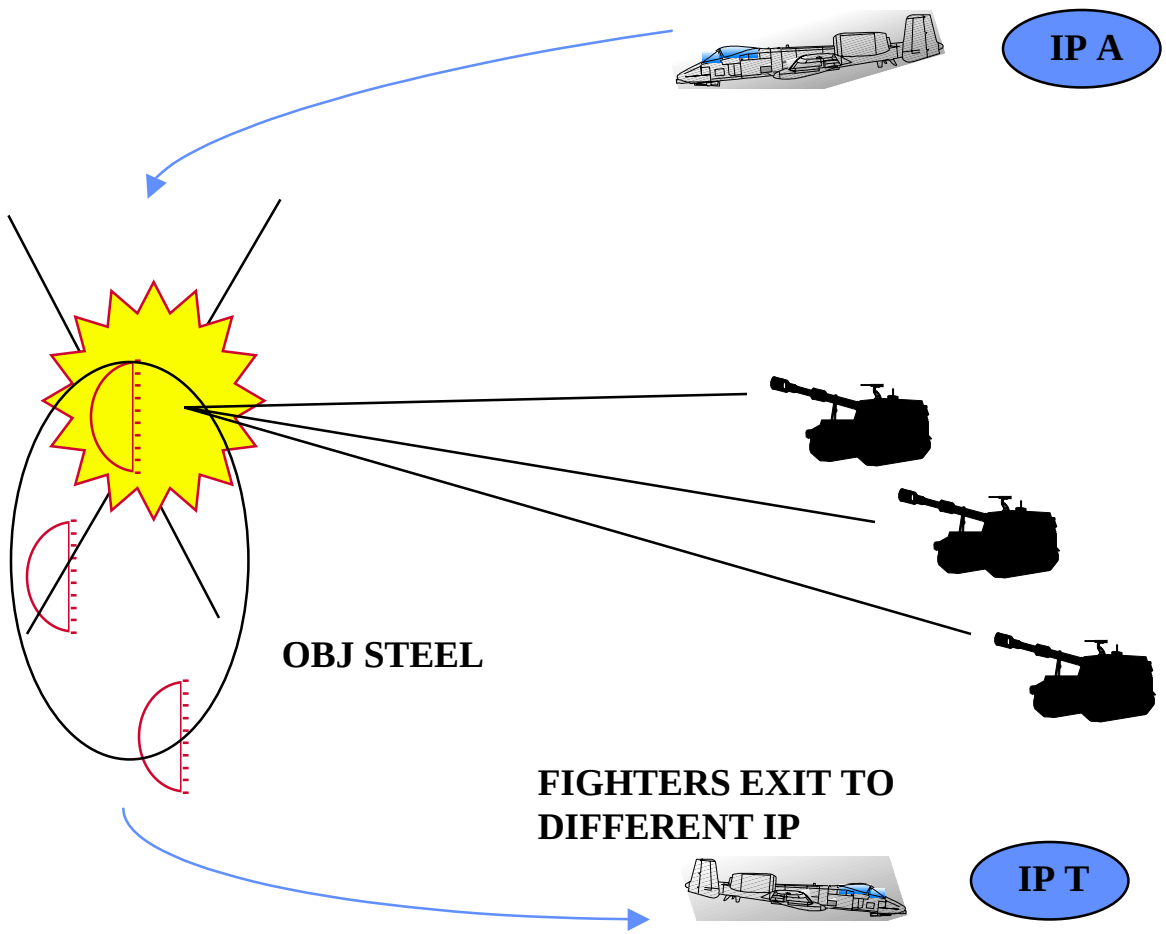


FSOs/ALOs DETERMINE TWO HEADINGS WHICH WILL KEEP THE AIRCRAFT SEPARATED FROM THE GTL BY 25 DEGREES OR MORE.



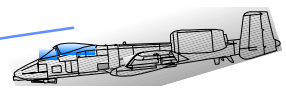
CAS / ARTILLERY ATTACK - SAME TARGET

IN THIS EXAMPLE THE ALO HAS GIVEN THE FIGHTER AN ATTACK ZONE FOR INGRESS AND EGRESS. THE FIGHTERS FLY WITHIN THE ATTACK ZONE, THUS REMAINING LATERALLY SEPARATED FROM THE GUN-TARGET LINE UNTIL IT CROSSES THE ARTILLERY TARGET AREA.



ONE OR MORE FIRING UNITS ENGAGE CAS TARGET

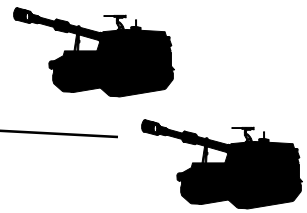
CAS / ARTILLERY ATTACK - SAME TARGET



IP A

ACA BLUE

FIGHTERS APPROACH THE ARTY TGT AREA LATERALLY SEPARATED FROM THE GTLs, THEN INGRESS WITHIN THE SPECIFIED ATTACK ZONE. THE FINAL CONTROLLER ISSUES EGRESS INSTRUCTIONS WHICH TAKES THE FIGHTERS AWAY FROM OTHER INDIRECT FIRES AND RETURNS THEM TO IP "A".

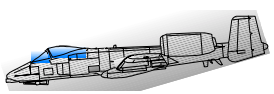


ACA BLUE

SA-6

OBJ STEEL

ARTY AND MORTARS ENGAGING TARGET OUTSIDE ACA



"EGRESS RIGHT, RETURN TO IP A"

CAS / ARTILLERY ATTACK - SAME TARGET

DETERMINING ORD 1

STEP 1:

* **DRAW A LINE FROM THE FIRING UNIT TO THE SUPPRESSION TARGET.**
* **DETERMINE THE GUN-TARGET RANGE AND THE VERTICAL INTERVAL (VI) BETWEEN THE FIRING UNIT AND THE TARGET.**

STEP 2:

* **DETERMINE THE CHARGE TO BE USED.**
* **FIND THE APPROPRIATE TFT TRAJECTORY CHART FOR THE SELECTED CHARGE.**
* **DETERMINE THE TRAJECTORY ARC THAT WILL ACHIEVE THE TARGET RANGE WITH THE VI APPLIED.**
* **IF THE TARGET FALLS BETWEEN TWO TRAJECTORY ARCS, USE THE HIGHER ARC.**

CAS / ARTILLERY ATTACK - SAME TARGET

DETERMINING ORD 1

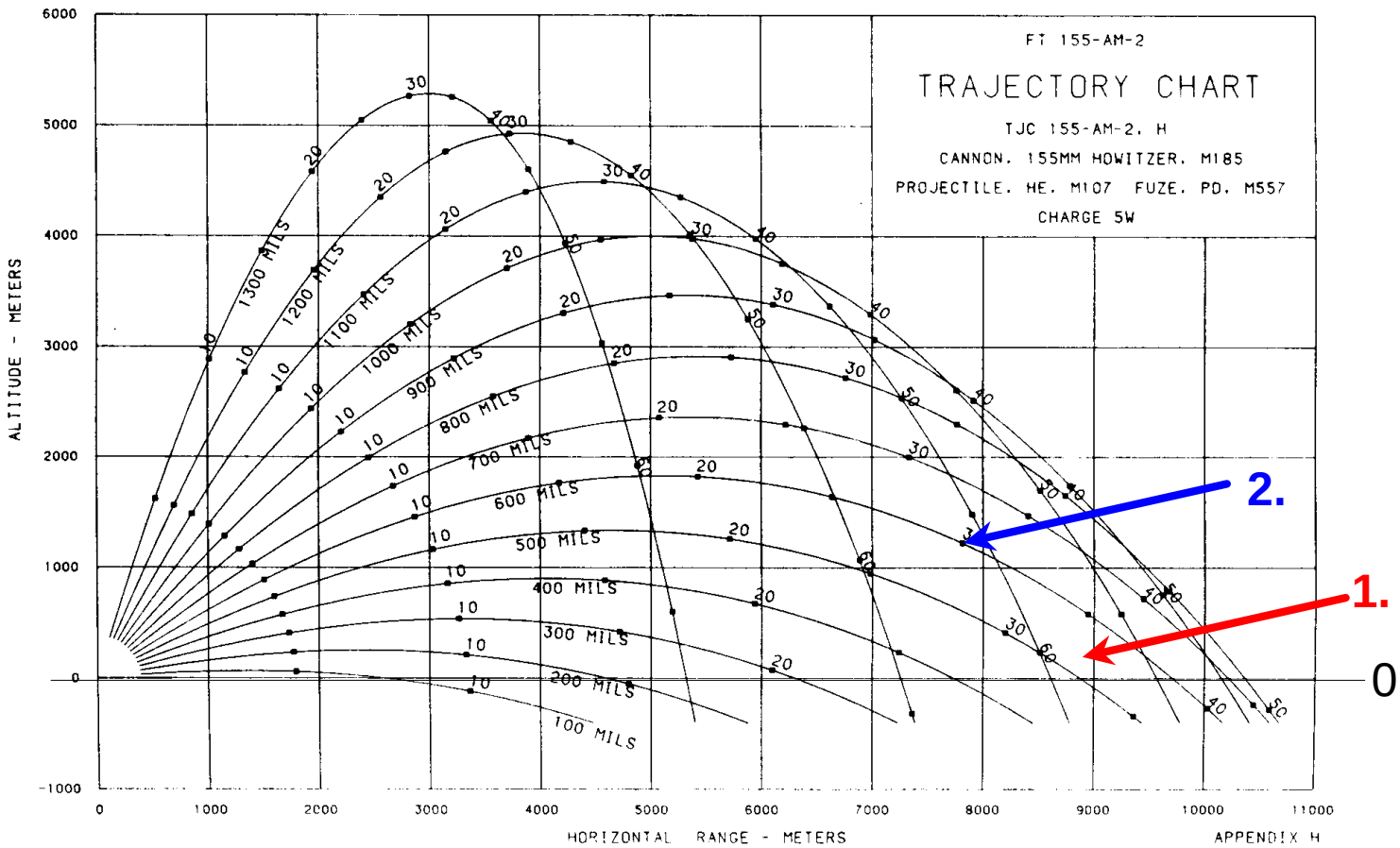
STEP 3:

* **DETERMINE THE ALTITUDE OF THE TRAJECTORY AT A POINT 1,000 METERS SHORT OF THE TARGET ALONG THE GTL.**
* **CONVERT THE TRAJECTORY ALTITUDE FROM METERS TO FEET BY MULTIPLYING THE ALTITUDE BY 3.3.**
* **ADD 1,000 FEET TO THIS CONVERTED ALTITUDE.**
* **THE SUM OF THESE TWO NUMBERS IS ORD 1.**
* **USE THE ORD 1 ALTITUDE OR 3,000 FEET AGL, WHICHEVER IS HIGHER, AS THE CAS STAY ABOVE (SA) ALTITUDE.**

STEP 4:

* **EXPRESS THE SA ALTITUDE IN FEET MSL TO THE FIGHTERS BY ADDING THE TARGET ALTITUDE TO ORD 1.**

DETERMINING ORD 1
TRAJECTORY CHART EXAMPLE



Note: Use this slide in conjunction with the slide titled "Determining ORD 1 Sample Problem."

DETERMINING ORD 1 SAMPLE PROBLEM

NOTE: REFER TO THE SLIDE TITLED "DETERMINING ORD 1 TRAJECTORY CHART EXAMPLE" IN CONJUNCTION WITH THIS SAMPLE PROBLEM.

1. - GT RANGE IS 8,900 M, CHG 5 WB, VERTICAL INTERVAL IS + 300 M. (Compare this information to the Number 1 marked on the trajectory chart slide)

2. - SELECT THE 600 MIL ARC. (+300 M VI PUTS TARGET ALTITUDE ABOVE THE 500 MIL ARC, YOU MUST INTERPOLATE UP.) AT THE 7,900 M RANGE, DETERMINE TRAJECTORY ALTITUDE ALONG THE 600 MIL ARC. THIS ALTITUDE IS 1200 M. (Compare this information to the Number 2 marked on the trajectory chart slide)

3. - MULTIPLY 1200 M BY 3.3 AND ADD 1,000 FT, THUS DETERMINING THE ORD 1 TO BE 4,960 FT AGL, EXPRESS THIS TO 5,000 FT FOR SIMPLICITY. SINCE ORD 1 IS HIGHER THAN 3,000 FT YOU MUST USE ORD 1 AS THE MINIMUM BOMBING ALTITUDE.

4. - DETERMINE SA ALTITUDE FOR THE FIGHTERS BY ADDING THE TARGET ALTITUDE TO THE ORD 1. (ASSUME TARGET ALTITUDE WAS 2,300 FT, THEN THE SA ALTITUDE IS 7,300 FT MSL.)

CAS / ARTILLERY ATTACK - SAME TARGET

SUGGESTED DUTIES / RESPONSIBILITIES

FSO	ALO	FDC PROVIDES
SEAD CFF	IP / 9-LINE	CHARGE
ORD 1	ATTACK HEADING	RANGE
SA-ALTITUDE AGL	SA-ALTITUDE MSL	VI

CAS / ARTILLERY ATTACK - SEPARATE TARGETS

SUGGESTED DUTIES / RESPONSIBILITIES

FSO	ALO	FDC PROVIDES
SEAD CFF	IP/9-LINE	MAX ORDINATE
MAX ORD + 1000 FT	ATTACK HEADINGS	
SA-ALTITUDE AGL	SA-ALTITUDE MSL	